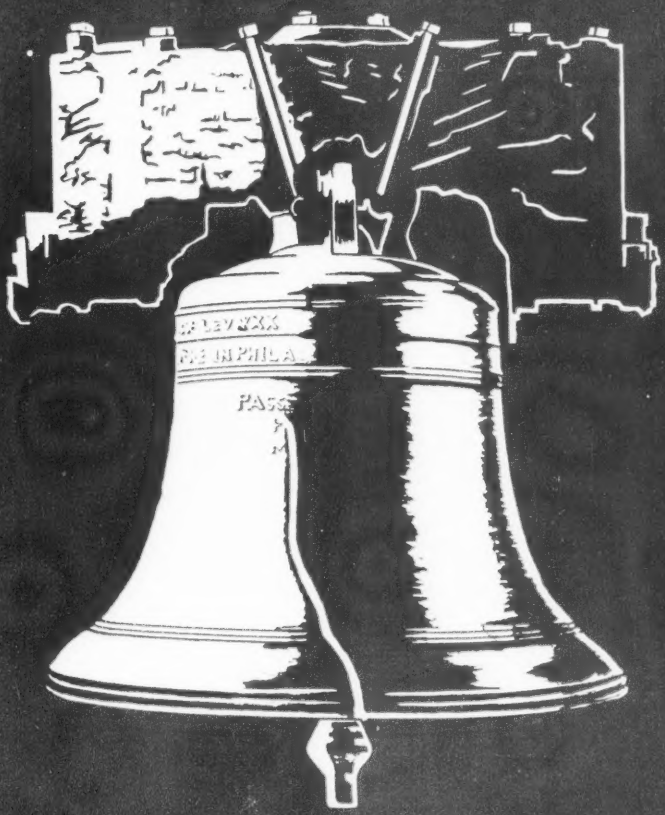
The Post Chapel, Fort Sill

JULY 1951

ARMY INFORMATION DIGEST



"Proclaim Liberty throughout all the land . . ."

1776-1951

ARMY
INFORMATION
DIGEST

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HOUR OF OPPORTUNITY

Whether it involves leading a squad on the firing line, supplying a division in the field or performing occupation tasks, Army duty today offers unique opportunities for youth to demonstrate capacities for management and leadership, the Secretary of the Army points out in this month's lead article.

Also in this issue, the Assistant Secretary of the Army stresses the time factor in our mobilization and rearmament programs as an element of critical importance in this Nation's race for peace.

CHARTING THE PATH

A little-known but indispensable helpmate of the Armed Forces in peace and war is the Coast and Geodetic Survey whose charts and maps insure the safety of mariners and pilots. The Survey contributes to the success of ground operations as well by providing the data necessary for our Armed Forces to pinpoint targets while moving with assurance over unfamiliar terrain. The Director of the Coast and Geodetic Survey describes the wide ranging operations of this uniformed service in this month's DIGEST.

BATTLE DOCTRINE

At The Infantry School, as in other training centers of the combat arms, the lessons of battle experience are quickly translated into doctrine. Observers in Korea, for example, are constantly studying the applications of principles and methods taught at the School; and the Commandant himself until recently commanded the 24th Division in Korea. In this issue, Major General John H. Church tells how the mission of The Infantry School is being fulfilled.

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ARMY INFORMATION DIGEST

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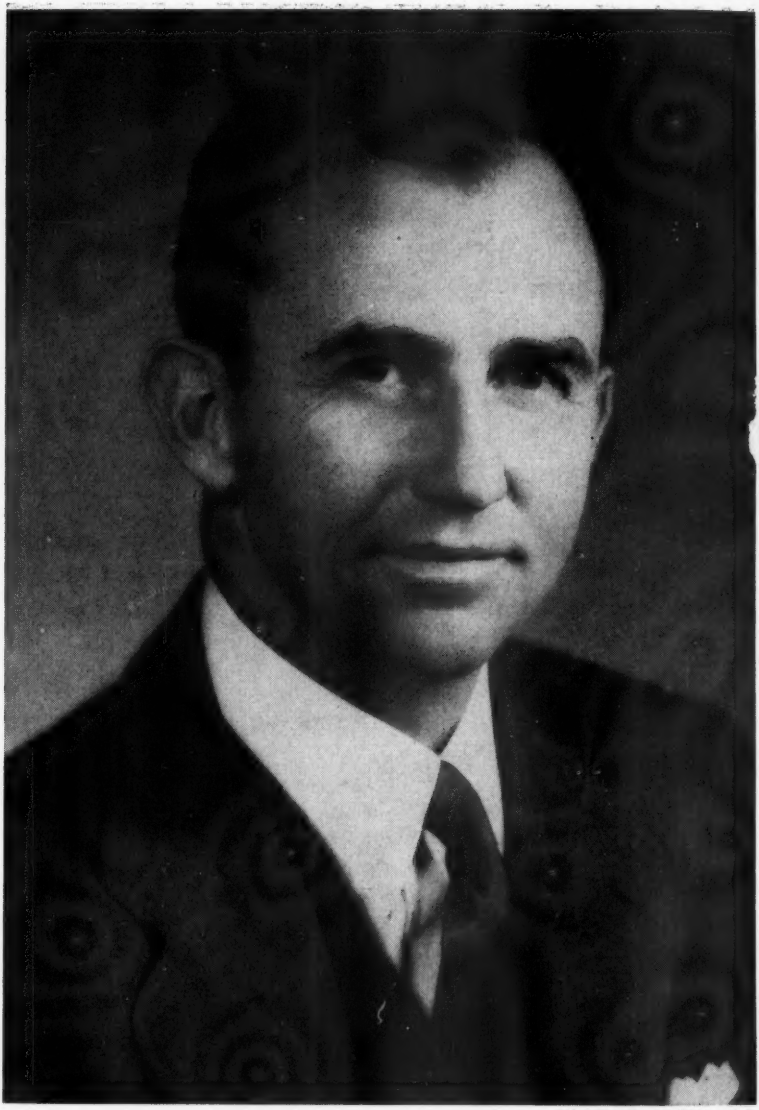


U. S. Army Photograph

THE HONORABLE FRANK PACE, JR.

TODAY'S CHALLENGE--YOUTH'S OPPORTUNITY

By

THE HONORABLE FRANK PACE, JR.

Secretary of the Army

TODAY we often hear it said that we Americans are living in a period of imminent danger without precedent in our history. Yet not too many generations ago our pioneer forefathers also lived and worked under extremely perilous and difficult conditions. While trying to clear his land and pursue other peaceful tasks, the pioneer had to keep his rifle nearby to defend himself against ever-recurring Indian attacks. Often along our western frontier wars flared, even as war flares on our global frontier in Korea today.

In that hardy pioneer society it was the accepted responsibility of all men, boys and even women to help defend the community against any aggressor. That traditional responsibility of the citizen to share the defense of his country has not changed. In World War II we were a Nation in arms. If another general war should ever come, it would be the same.

In the vanguard of the Nation in arms are always our young men, for combat is the young man's job, requiring the physical toughness, strength and vitality that only youth possesses. We have a young Army in Korea. That is the reason our infantry is able to scale precipitous mountains to close with the enemy and why our artillerymen are able to beat off the guerrilla attacks, delivering sustained fire day and night. Our tankers have shown the *elan* and dash of their cavalry forebears, our combat engineers have fought off the enemy while they worked and our supporting supply and service troops have been able to work around the clock—for theirs is the stamina of youth. Everywhere, during my trip to the Korean front, I found our soldiers displaying all the courage and hardihood we revere in our pioneer forefathers—a calm and

From an address at Purdue University, Lafayette, Indiana, 30 April 1951.

willing acceptance of their responsibility to fight when their country needs them.

But there is no question that Americans traditionally look upon military service as a necessary but unhappy interruption to cherished civilian plans and dreams. This traditional attitude obscures an important truth—that Army service offers unique opportunities to the young man. His period of service is by no means a complete gap in his life. In no sense does it represent a waste or loss of years which would otherwise be used to personal advantage. To the contrary, it offers to the young man opportunities for experience in management and executive leadership that in the normal course of civilian life would come only after many years.

In the Army's technical services the practical value of military service is readily apparent. While in Korea, I saw our Engineer and Transportation Corps soldiers working together to repair and rebuild damaged railroad lines, roads and bridges. This reconstruction was going on day and night under great pressure despite handicaps of material shortages and inexperienced Korean labor. Here the American soldier's fine technical training, his flair for improvisation, his capacity for hard work and his ability to organize and direct the work of hastily recruited, unskilled local laborers is paying off. Certainly the rare experience he is gaining would make him a more valuable man in any related civilian field.

Everyone has heard of the superb job our Medical Service is doing in aid stations at the front lines and in hospitals in Korea and Japan. In Signal, Ordnance and Quartermaster activities as well—in fact in all of the Army's technical services—a young man has an unusual opportunity to increase his technical ability and value while serving his country in a vitally important capacity.

It is unfortunate, however, that the very great personal advantage derived by the soldier in the combat arms of the Army is not always so apparent. It is unfortunate because the combat arms develop to a much greater extent the one commodity which will always be in short supply in any human endeavor. That commodity is leadership—the ability to understand and handle men, to select the right man for the job, to organize technicians and specialists into smooth-working teams, to supervise and coordinate their efforts successfully, to inspire them during times of stress. A man who can do these things and who can make sound decisions despite uncertainty, con-

fusion or danger, the man who has the drive to act on those decisions and follow through on assigned missions, is a man who will always be sought after and richly rewarded in any field, military or civilian.

This is the type of young leader the Army's combat arms have traditionally produced and continue to produce. Without leadership of this brand, we never would have defeated the highly trained German and Japanese armies in World War II. Without leaders of this type—from corporal to general—the Army's fighting units would not have been able to retain their hold in Korea.

Combat is the ultimate reason for the soldier's existence, and battles make the headlines. Therefore, many people think that the combat leader spends most of his time in the combat zone directing tactical operations against the enemy. This is not so. A very large part of his time is spent supervising the housekeeping of the military community which is his command, moving his men and planning future action. Fighting is the most important part—but only one part of many Army operations in the combat zone.

The Army's problems in the combat zone are uniquely difficult as compared to those of the other services. A ship carries in one bottom men, guns, ammunition, food, kitchens, hospital, fuel, maintenance shops—everything that is needed to operate in combat. To move that community, the captain says "Full speed ahead," and the ship and the community move. The Air Force maintains its supporting services at a fixed base from which its planes can accomplish their combat mission and then return to their community.

The Army, on the other hand, with an even more complex community, must move that community intact from one point to another, not only maintaining all the community services in good order while doing so but often fighting every step of the way. It must move its personnel, food, shelter, hospitals, records and other services; its guns, ammunition and repair shops; its vehicles with their maintenance shops and replacement parts as well as their fuel. It must lay its communications lines, build its roads and bridges, provide water and electricity as it goes; and it must maintain a vast supply system to support all these community activities so that everything is in the right place at the right time.

This tremendously complicated problem that is uniquely the Army's own, exists at every level of the Army. The com-

pany commander, in charge of the basic fighting unit of the Army, deals with all these problems to a certain degree. He is in command of some two hundred men and thousands of dollars worth of weapons, equipment and supplies. He is responsible for the feeding, clothing and shelter of his men; for the maintenance and proper use of their weapons, vehicles and equipment. He must see that hundreds of individual items of supply are always on hand in adequate quantity. He must efficiently manage his fighting unit—which is also his community—as well as lead it effectively in combat. This commander, with all of these demanding responsibilities, is a young man, usually in his early twenties.

Is it any wonder that young combat officers trained in this realistic school of experience displayed astonishing talent in handling the purely administrative tasks assigned the Army after World War II? Take, for example, some of the jobs our combat units handled in Europe. When the war ended there, millions of displaced persons roamed through our zones of occupation in Germany and Austria. Local government, staffed mostly by Nazis even at the village level, broke down almost completely. To our troops fell the job of running an interim American Military Government. They accomplished this mission with conspicuous success. Employing the hard common sense of Army troop leaders, they analyzed unfamiliar problems and came up with workable solutions. In a short time, street cars began running again, light and power facilities were repaired, reorganized police detachments began to function, the rubble of war was cleared from roads and streets, temporary bridges appeared between scarred abutments and civil government was reestablished. Into camps provided by the Army flowed the millions of homeless to be fed, clothed and sheltered by the Army. In a remarkably short time after the last shot was fired, a semblance of normal life began for the war-ravaged peoples in the American zones of occupation.

It was much the same in Japan. There most local governments remained intact but the Army had to furnish administrators and specialists to supervise the economic, political, social and psychological regeneration of Japan. There, too, were the problems of caring for the homeless, of repairing the cities damaged by war. The political and psychological reorientation was a difficult task, yet almost miraculous success was achieved in impressing the Japanese people with the worth of our way of life and in educating them to follow that way.

In the face of the extraordinary demands which the Army must make upon its men, there is no more important task than their initial selection, classification and training. The Army needs the best young men this Nation can offer and it spares no effort to get them. After it gets them, it is vitally important that they be properly classified and assigned to the jobs they can do best. We have overlooked no possibility for improving this process.

In addition to classifying new men entering the Army in terms of their civilian skills and abilities, we have set up a special screening program for spotting critical specialists. We have even inaugurated a system for consulting industry and the labor unions in advance to obtain information on the technical competence of men entering the service, so that they can immediately be assigned to specialized fields. And we have, of course, a system for reconsideration of assignment from time to time to insure that there are no square pegs in round holes as far as any system can prevent it.

The next vital step in our program is the best possible training of our men. Based on first-hand observation, I believe that the young men entering the Army today are getting the most realistic and effective training that American soldiers have ever had. We have benefited greatly by the lessons of Korea and we have incorporated those lessons into our training programs as fast as they are reported and evaluated. Furthermore, we have made particular efforts to assign returning veterans of the Korean fighting to our training centers so that their invaluable battlefield experience can be passed on to new recruits.

In the midst of our intensive physical and technical training we have not overlooked other elements even more vital to the making of a soldier. We realize that the ultimate test a soldier faces on the battlefield is mental and moral. To withstand the stresses of war which have no counterpart in his civilian experience, the soldier must possess a deep belief in the cause for which he is fighting. And he must have the toughness of character that enables him to fight on though beset by confusion, fear and uncertainty.

Therefore, throughout our training programs we place great emphasis on developing moral and mental stamina in our soldiers. Our principal organized efforts along this line are focused in the Character Guidance Program coordinated by our chaplains and in the Troop Information Program which

helps our soldiers to understand and appreciate why they are fighting and what they are fighting for. In addition the Army also conducts an extensive Troop Education Program which has received high praise from civilian educators. I consider these phases of our training to be of the highest importance, for without the moral courage and character to sustain him in battle, mere military skill is useless to the soldier.

The real meaning behind the Army's gallant and inspired performance in Korea—the true key to the Army's success in any endeavor, for that matter—lies in the excellence of the Army's leadership, particularly among the noncommissioned officers and junior officers at the lower levels where plans, policies and programs are eventually translated into action.

In the Army, the young leader is the final implementer of the broadest and most ambitious Army plans. Therefore we spare no effort to locate potential leaders among our new recruits and to develop and encourage them. We send a very high percentage of our most promising recruits to a special Leaders School as soon as they have finished basic training. Most of these become the noncommissioned leaders—the "noncoms" traditionally and quite accurately called the backbone of the Army. Many go on to Officer Candidate School and the best graduates may be offered Regular Army commissions.

Every day, in every operation, at every level of the Army, there is a constant search for leaders. When we find them, we afford them every opportunity to move up according to their ability. In the United States Army there is no curb on competence. This does not mean that every recruit will become a general, but it does mean that every soldier has full opportunity to advance as far as his ability and his industry recommend.

The Army always needs young people of intelligence, imagination and character. Particularly today, in this time of challenge, we can never have too many with these qualifications—and we can guarantee such young men and women unlimited opportunity to shoulder increasingly heavy responsibilities to the full limit of their capacity.

DEVELOPING INFANTRY COMBAT LEADERS

By

MAJOR GENERAL JOHN H. CHURCH

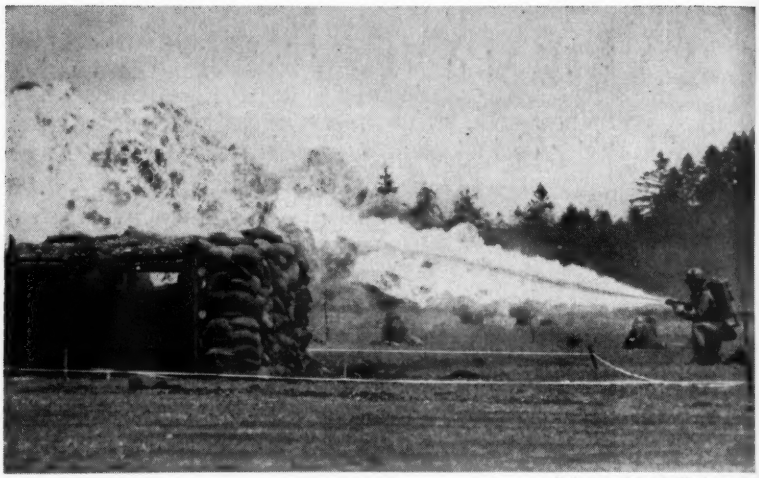
THE tools and techniques of war change constantly but the task of the foot soldier—to close with and destroy the enemy—never varies. His need to be led competently and aggressively is equally unchangeable. Hence, the primary mission of The Infantry School—"the development of Infantry commanders"—will remain the same as long as there is need for either infantry or an infantry school.

The Infantry School at Fort Benning is the agency that gathers, tests and applies lessons learned from battle, including analysis of the possibilities of the new ideas of American infantrymen everywhere. The thoroughgoing techniques and modern equipment used and the many leaders it has produced have established The Infantry School in its place among the world's service schools.

While the necessity for the infantry soldier has always been recognized, it has taken the vision and ceaseless energy of generations of progressive American infantrymen to establish and make The Infantry School what it is today. The German baron, von Steuben, who aided General Washington during the American Revolution, found our militia untrained, without a semblance of a uniform manual of drill and with no similarity of organization among units—in fact, no teamwork of any kind. After the war he was instrumental in laying the foundations for the school of the soldier with arms which is a spiritual ancestor, at least, of today's Infantry School.

The young Nation's militia was still very poorly trained at the time of the War of 1812—so much so that General Jacob Brown, when he became chief of the Army, directed that a school for infantry be established. This school opened in 1826

MAJOR GENERAL JOHN H. CHURCH, USA, is Commanding General, The Infantry Center and Commandant, The Infantry School, Fort Benning, Georgia.



Infantry School Photograph

Practice in use of the flame thrower is part of The Infantry School's instruction in tactical employment of weapons.

at Jefferson Barracks, near St. Louis, Missouri, but closed after two years when all the troops were sent to fight the Indians.

More than fifty years later, in 1881, General W. T. Sherman established the next ancestor of The Infantry School at Fort Leavenworth, Kansas—the Infantry and Cavalry School which evolved into the Command and General Staff College.

In 1907, concerned with the poor quality of marksmanship in the Army, Lieutenant General Arthur MacArthur organized the School of Musketry at the Presidio of Monterey, California. General MacArthur's school was perhaps the most direct forerunner of today's Infantry School. He set up firing ranges, employed firing problems in the field, used demonstration troops and worked out the coach and pupil method of marksmanship training—all techniques still used in training at Fort Benning. The School of Musketry was made a national service school under War Department jurisdiction and was moved to Fort Sill, site of the School of Fire (The Artillery School).

Both schools began to expand and the School of Musketry soon was reorganized into an Infantry School of Arms with a much greater emphasis on contemporary weapons and their uses. In May and June 1918 the Machine Gun Department was detached and sent to Camp Hancock, Georgia, where it soon began training from 20,000 to 30,000 men at a time. The Department of Small Arms was moved to Camp Perry, Ohio,

Finally, after considerable high-level study, a new site for a permanent infantry school was chosen. At that time Major General Paul B. Malone was largely instrumental in making the Army aware of the need for such a school and in keeping it going later when it was threatened with abandonment. Shortly before the Armistice which brought World War I to a close, orders from the War Department moved both the Hancock and Perry activities to Columbus, Georgia.

Located about nine miles south of Columbus, the new school's home was named Camp Benning in honor of Confederate Brigadier General Henry Lewis Benning of Columbus. The reservation now covers 182,626 acres including part of the Chattahoochee River which forms the boundary between Alabama and Georgia. Almost every conceivable type of terrain on which infantry might be employed is included here.

The School grew steadily between the first and second World Wars. In 1920 The Infantry School was authorized as the official name by the War Department; and in 1935 the magnificent building now housing the School was built.

Prominent figures in the history of the U. S. Army have been closely associated with Fort Benning and The Infantry

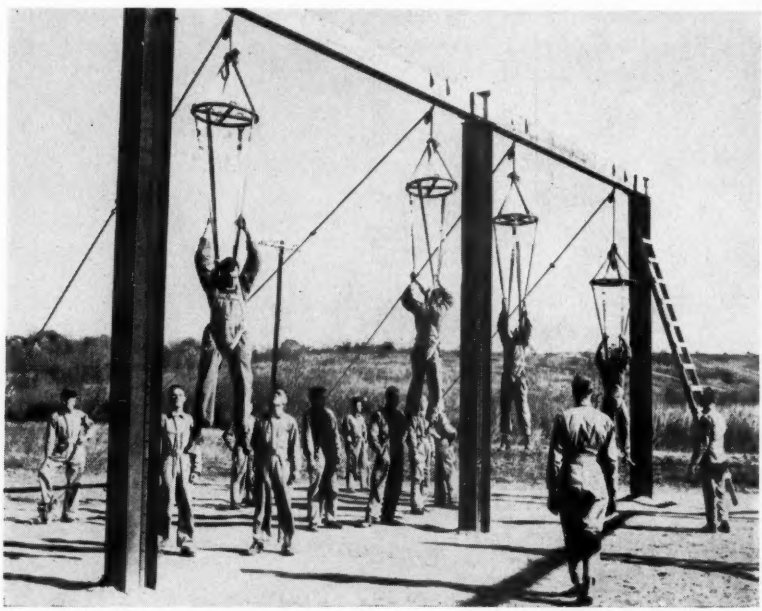
Infantry School Photograph

Students execute a river crossing operation to gain experience in this vital phase of combat.

School. Among those who have been there as Commandant or Assistant Commandant are Generals of the Army George C. Marshall and Omar N. Bradley, General Courtney H. Hodges, Major Generals Briant H. Wells, Leven C. Allen, Charles H. Bonesteel, Fred L. Walker, John W. O'Daniel, and Withers A. Burress. Instructors destined for high posts of leadership included Generals J. Lawton Collins, Mark W. Clark, Joseph W. Stilwell and Lieutenant General Alvan C. Gillem.

The mission of the School—to support and train infantrymen as combat leaders—is about the only thing which has remained unchanged. Improvements in instruction and doctrine are continuously being incorporated. Part of the job of the School is to be alert to everything that concerns infantry in training and in combat—an interest which includes anything from a new device assuring better vision at night to a suggested change in the organization of the infantry regiment.

Both major wars in our generation have proved that what "the book" says about ground warfare is practicable—and much of infantry's "book" has been written at the School. Early in World War II, staff members of the School and ob-



Infantry School Photograph

In the Airborne Department, students learn safe landing techniques on suspended parachute harnesses.

Infantry School Photograph

The School familiarizes students with weapons proven in modern war, such as this 57mm recoilless rifle.

servers from Army Ground Forces went to the theaters of operations to study the application of principles and methods taught at the School. Early in that war and largely as a result of observers' reports noting a lack of stamina among the troops, battle conditioning, including heightened physical training, obstacle courses and the like, was introduced into the curriculum. Most recently, the conflict in Korea uncovered a weakness in training for night fighting among our troops. Immediately night warfare training was intensified.

The mission of The Infantry School is detailed in *The Infantry School Guide for Faculty and Staff*—to develop leadership in all ranks; to instruct infantry officers and officers of other branches in standardized infantry tactics and techniques with emphasis on practical instruction applicable to the training and leading of all combat units up to and including the reinforced infantry regiment; to instruct officers in the organization, functioning, duties and responsibilities of unit staffs in units up to and including the regiment; to instruct and qualify officers and enlisted men in airborne tactics and techniques; to furnish a working familiarity with the tactics and techniques of associated arms in coordinated tactical employment; to train selected officers and enlisted men for special

Courses Conducted at The Infantry School

Officer Candidate Course. Twenty-two weeks of training to develop selected warrant officers and enlisted personnel into officers.

Associate Infantry Company Officer Course. Fifteen weeks, for officers active in a reserve component whose assignment, actual or anticipated, is to Infantry; or Regular Army officers assigned to Infantry who require refresher training; or for supplementary training of other officers.

Infantry Officer Advanced Course. A course of approximately thirty weeks in the duties and responsibilities of field grade officers of the Regular Army or active members of the reserve components whose assignment, actual or anticipated, is to Infantry. The course is for infantry battalion and regimental commanders and division staff officers.

Associate Infantry Officer Advanced Course. A fifteen-week condensation of Infantry Officer Advanced Course for officers active in a reserve component whose assignment, actual or anticipated, is to Infantry; or for Regular Army officers assigned to Infantry who require refresher training, or for supplementary training of other officers.

Company Officer Refresher Course. Four weeks intensive training.

Field Officer Refresher Course. Four weeks intensive training.

Infantry Officers Communication Course. Fifteen and one-half weeks of training in the technique, characteristics, installation, operation and maintenance of infantry communication systems for company grade communication officers.

Infantry Motor Transportation Course. An eleven and one-half week course in motor transport and motor maintenance duties of officers and warrant officers in infantry units.

Airborne Course. Three weeks parachutist training for officers and enlisted men. Officers and noncommissioned officers take a fourth week of training in air transportability and jumpmaster duties.

Pathfinder Course. Five weeks training of officers, warrant officers and enlisted personnel for duty with an advanced airborne party.

Light and Heavy Weapons Infantry Leaders Course. A fourteen-week course to prepare noncommissioned officers to control and directly supervise training and tactical employment of infantry weapons sections or squads. Open to selected noncommissioned officers with technical and leadership qualifications.

Infantry Enlisted Communication Course. Seventeen weeks training to prepare enlisted men to supervise installation, operation and maintenance of signal equipment by an infantry communication section.

Infantry Radio Maintenance Course. Eighteen weeks training for enlisted personnel in organizational maintenance on field type radio equipment issued to infantry units.

Infantry Unit Automotive Mechanics Second Echelon Course. Ten weeks training for organizational mechanics and motor sergeants.

Operations Chiefs Course. An eleven-week course for noncommissioned officers. This course is coordinated in part with the Intelligence and Reconnaissance Chiefs Course.

Intelligence and Reconnaissance Chiefs Course. An eleven-week course for noncommissioned officers.

Sound Ranging Course. A six-week course designed to train enlisted personnel to control and supervise the training and tactical employment of an infantry regiment counterfire platoon.

technical duties necessary to the proper operation of infantry units up to and including the regiment; to serve as an agency of the Chief, Army Field Forces, in the development and perfection of infantry and airborne tactics and techniques; to prepare, process and revise training publications, Army extension courses, instructional manuals, training films and other publications; to conduct research relative to the improvement of the Infantry; and finally, to disseminate information to the Army relative to the instruction and training conceived by and in use at The Infantry School.

The School is organized in eight academic departments, six of them—Airborne, Automotive, Communication, Weapons, Tactical, and Staff Departments—concerned primarily with resident instruction. The Army Extension Courses Department issues correspondence courses to non-resident trainees while the Training Publications Department has charge of training literature and films and coordinates the School's responsibilities to the civilian components of the Army.

Currently, seventeen courses are conducted at The Infantry School for officers and enlisted men. (See box, page 14.) Officers of all components may apply for officer classes and qualified enlisted personnel may attend enlisted courses.

The first officer candidate class at Fort Benning since 1946 reported in February of this year. Instruction is patterned closely after the Fort Benning course which during World War II graduated nearly one-third of the officers commissioned during that war.

The Airborne Department is an outgrowth of the original Parachute School. With few exceptions, every week since the test platoon began training in June 1940 has seen the beginning of a new airborne class. By the middle of March 1951, some 138,000 qualified parachutists had been graduated.

During the calendar year 1950, a total of 3175 officers and 9099 enlisted men was graduated from courses at the School. It is expected that, with increased mobilization, the resident student population will expand greatly to more than 10,000 students in training.

The Infantry School distributes instructional material for use in organized non-resident programs by infantrymen in all components of the Army. The School is also charged with preparing all training literature relating strictly to infantry. Since 1947 the faculty has written or revised 30 field manuals and six training circulars covering the latest developments

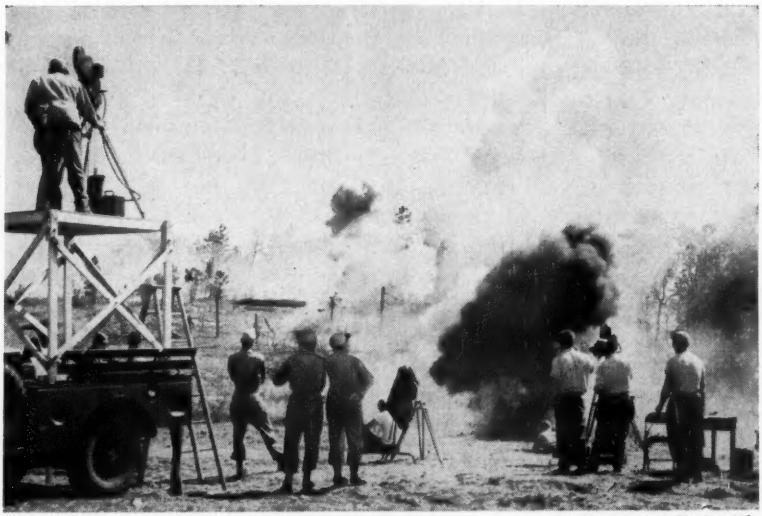
in tactics, weapons, communication, transportation, airborne training and staff principles as taught at the School.

The School answers hundreds of requests for material, distributes the Catalog of Instructional Material to units around the world and coordinates the production of infantry training films made on the Fort Benning reservation. The Army Extension Courses Department distributes its material to more than 7000 extension course students so that those not on active duty may keep their military education up to date.

Through its research and analysis office the School works closely with Army Field Forces Board Number 3, also at Fort Benning, in testing equipment and it carries on a constant interchange of ideas and material with sister schools.

The Infantry School is host to many visiting officers from friendly nations. Some visit the School briefly; some come as students of the regular courses. Joint Civilian Orientation Conferences are also held to familiarize top military and civilian leaders with latest infantry developments.

Thus in varied ways The Infantry School, as the vital center of infantry thinking in the United States Army, is carrying out its program of instruction, proud of its tradition of progressive development and its part in making the American foot soldier the world's best equipped and best led.



Infantry School Photograph

The Training Publications Department supervises the technical aspects of troop training films produced at Fort Benning.

THE COAST AND GEODETIC SURVEY

By

REAR ADMIRAL ROBERT F. A. STUDDS

WHILE basically a civilian agency, the United States Coast and Geodetic Survey of the Department of Commerce has for more than a century performed work essential in support of the Military Establishment. Ever since hostilities began in Korea, the bureau—one of the seven uniformed services within the purview of the Career Compensation Act of 1949—has channeled a major part of its effort into meeting military requirements.

The Coast and Geodetic Survey is not the best known of our Government agencies but it has the distinction of being one of the oldest. It had its inception in 1807 during the administration of President Thomas Jefferson who, earlier, had been requested by the Congress to cause a survey to be made of the coast, the outlying islands and the fishing banks, in the interest of safe navigation.

Jefferson enlisted the aid of leading scientists in selecting a plan of survey. The plan submitted by Ferdinand R. Hassler, a Swiss scientist who at that time was an instructor in mathematics at West Point, was ultimately adopted and Hassler was appointed superintendent of the "Survey of the Coast." Thus, at the very outset there was a connection between the Survey and the Military Establishment. Close cooperation with the Army Corps of Engineers, the Hydrographic Office of the Navy and the Air Force has been maintained through the years.

In the early 1830s the Survey was made a bureau of the Treasury Department and continued under Treasury jurisdiction until 1903 when it was placed under the newly organized Department of Commerce and Labor. In 1913, when Commerce and Labor were made separate Departments, the Survey remained part of the Department of Commerce.

REAR ADMIRAL ROBERT F. A. STUDDS is Director, United States Coast and Geodetic Survey.

The bureau's basic functions are surveying and charting the coasts and coastal waters of the United States, its territories and possessions; precise geodetic surveying in the interior of those areas; the study and prediction of tides and currents; collecting and disseminating geomagnetic and seismological data; and charting the Nation's airways. These activities result in the production of nautical and aeronautical charts indispensable to the navigation of ships in our coastal and inland waterways and to the operation of aircraft; they provide information of immense value to the surveying and engineering professions; and they contribute materially to numerous fields of applied science.

Coastal Surveys. Suggesting the magnitude of the task involved, coastal surveys cover more than 75,000 miles of shoreline and more than a million square miles of coastal waters. Survey parties in ships or launches equipped with echo-sounding machines measure the water depths, and "shoran" (short range electronic navigation) devices are used to determine the positions of those soundings. The topography of the coast is usually surveyed by shore-based parties. Photographic mapping methods have almost entirely superseded the rod and chain method. Tides are measured in order to establish a common datum plane for the reduction of soundings, and currents are observed in important harbors and waterways. On the basis of these observed data, tides and currents can be predicted and charted for years to come—predictions which are extremely valuable to mariners, small-boat operators, fishermen and coastal engineers.

Coastal surveys are a continuing process, for man and nature are constantly making important changes. This requires periodic resurveying of all areas to keep the charts up-to-date and to insure safe navigation. Not all of the Alaskan waters, for example, are adequately charted and one of the major tasks is to close the gaps in those areas.

"Coast Pilots"—ten volumes containing information essential to the mariner—are important adjuncts to the nautical charts. These are compiled and published by the bureau and are kept up-to-date by annual supplements.

Geodetic Surveys. In 1871 the Coast Survey was authorized to extend its work inland in order to establish a geodetic network consisting of monumented points accurately located in latitude and longitude and in relation to each other. These positions are established by long-line measurements taking

into account the curvature of the earth's surface. Between 1871 and 1899 the Atlantic and Pacific coasts were connected by a long arc of triangulation approximately along the 39th Parallel, one of the greatest feats in the annals of geodesy. From this and the coastal triangulation which had been in progress since 1816 there developed what is today a closely spaced net of geodetic control stations, the geographic coordinates of which have been determined most accurately.

Each season a number of highly mobile Survey parties operate in various parts of the country—some engaged in triangulation, others in leveling along highways and railroads to determine elevations above mean sea level. After reconnaissance to ascertain the most suitable locations, various triangulation stations and the points whose elevations have been determined are permanently monumented, usually by metal disks set in concrete. This geodetic network has many important uses. It provides the framework for the accurate topographic mapping of the United States; it is used by private and public surveyors and engineers throughout the country in surveying everything from property lines to major construction and reclamation or flood-control projects; and it is vital to defense installations, fire control and to other military needs.

Other Survey Operations. Long-range tidal information is obtained from over 90 primary tide stations at principal ports and other strategic locations on the Atlantic, Gulf and Pacific coasts of the United States, in Alaska and on certain Pacific Islands. In addition, information is exchanged with foreign countries. These data, supplied to the Armed Forces during World War II in a form suitable to intelligence requirements, proved invaluable in planning amphibious operations.

Magnetic observing early became one of the important collateral functions of the Coast and Geodetic Survey. Findings accumulated by the bureau showing the variation of the compass in charted areas have been supplied to the Hydrographic Office of the Navy and the Army Map Service for use on their maps and charts in all parts of the world.

The Survey studies the magnitude and motion characteristics of earthquakes throughout the world, especially of the seismic regions of the United States and possessions. Delicate instruments are operated at the bureau's magnetic and seismological observatories to detect earthquakes and analyze the results. In addition, local reports on earthquakes throughout the United States and from some foreign areas are received, coordinated

and analyzed. The information so obtained is used by construction engineers in designing earthquake-resistant structures, by insurance actuaries computing rates in areas of earthquake hazard and for other scientific and technical purposes. It has numerous military applications in design of installations, studies of the effects of explosions, vibration studies in munitions plants, and the like.

Gravity studies are made by the bureau to determine the shape and nature of the earth's crust. Besides their military value, these studies have contributed substantially to the science of geophysical prospecting for oil.

The Survey in Time of War. Science and technology are the indispensable handmaidens of modern warfare. The Coast and Geodetic Survey, on the basis of its long experience in the development and use of precision instruments and equipment, has rendered numerous valuable contributions to the military. With its well-equipped instrument shop and its modern radiosonic laboratory, the bureau is in a position to assist the Armed Forces in technological research and development. In addition, the Survey has brought together a corps of highly skilled personnel, both commissioned and civilian, who constitute a reservoir of expert talent in scientific and technological fields which can be made available to the military.

The duties to be performed by the United States Coast and Geodetic Survey in time of war and the nature of its cooperation with the Department of Defense in time of peace, in preparation for its duties in war, are defined by regulations promulgated in accordance with the National Emergency Act of May 1917. They provide for continuance of the agency's normal work, subject to such restrictions or modifications as may be agreed upon jointly by the Secretaries of Defense and Commerce. They direct the performance of such special assignments as the Department of Defense may request; the maintenance of liaison with the Armed Forces; and the undertaking of such training programs as may be considered desirable. The regulations further provide for the transfer of commissioned officers and civilian personnel to the direct jurisdiction of the Armed Forces and, finally, for the transfer of ships and equipment as required during war.

Under these regulations, the Survey during World War II performed many valuable services for the Military Establishment. It produced millions of nautical and aeronautical charts, including target charts for pin-point bombing. Six of its

major survey ships were transferred to the Navy. Over half of its commissioned officers were transferred to the Armed Forces and more than a thousand of its civilian employees were in uniform.

The Postwar Period. The close of World War II brought relatively little reduction in the work done for the Armed Forces. Charts needed by the Navy and Air Force continued to be produced in far greater volume than before the war. Geodetic operations aimed at completing the triangulation network in Alaska were accelerated and renewed efforts were made to close the gaps in the hydrography of Alaskan waters.

A notable project begun in the pre-Korean period is the Inter-American Geodetic Survey conducted under the supervision of the Caribbean Command of the Army with the cooperation of the State Department and various American Republics. The present emphasis on plans for hemispheric defense makes this project particularly significant from a military standpoint. Coast and Geodetic Survey officers have been sent to Central and South American countries to install tide gauges and otherwise assist in the Survey. The desired end result will be a strong geodetic net covering the entire Western Hemisphere to serve as the framework for accurate mapping.

For many years the Survey has participated in the Cooperation with the American Republics program sponsored and financed by the Department of State. Under this program a large number of students from Central and South America have been trained in this country in surveying and charting techniques. Similarly, under the Philippine Rehabilitation program, many students from the Philippine Republic have received training in bureau methods. The bureau has also cooperated with other foreign governments in promoting uniform standards of surveying and mapping.

Following the destructive tidal wave which struck the Hawaiian Islands in 1946, the Survey in cooperation with the armed services and other agencies developed the Seismic Sea-Wave Warning System designed to warn the Islands of impending tidal waves. The system—utilizing a special seismic sea-wave detector instrument developed in the bureau—consists of a network of both tidal and seismological stations to detect submarine earthquakes and determine if they are potent enough to produce destructive sea waves. Both Army and Navy communications networks are used in the system.

The Korean Crisis. The impact of the Korean crisis caused

sharp increases in the demand for nautical and aeronautical charts. Much of the demand for nautical charts was occasioned by the recommissioning of naval vessels which had been in "mothballs" since the end of hostilities. The Survey also assists the Hydrographic Office whose overtaxed facilities threatened to create a serious backlog in production of charts of areas outside the United States.

Aeronautical charts are in similar demand. In addition to the regular series published in peacetime, numerous special charts of strategic areas, search and rescue charts, practice bombing charts and air-defense grid overprints for regular sectional charts are being turned out. At the present time the bureau's pressroom is on a three-shift, 24-hour basis and is averaging approximately 7,000,000 impressions per month—a figure which is expected to rise to 11,000,000 soon.

One example of the usefulness of the Survey's everyday operations to military requirements was demonstrated in late 1950. Planning for an amphibious invasion in North Korea, military authorities called upon the bureau for tidal information concerning certain points along the northwest Korean coast. A few relatively simple calculations provided the information for some of the points. As for Inchon, where the main operation later took place, the necessary information was already available in one of the standard Tide Tables published by the Survey during the previous year. Special predictions for certain areas, as requested by the Department of Defense, are being made from time to time.

Compilation of the 1950 World Isogonic Chart showing lines of equal magnetic declination for all parts of the world was completed shortly after the Korean crisis began. Published in three sections by the Hydrographic Office of the Navy, the chart is based on findings accumulated by the Survey in its role as repository of world magnetic information.

The outbreak in Korea affected geodetic operations comparatively little; they have continued much the same as during the post World War II period, with more emphasis on Alaska. However, a number of special surveys have been undertaken at the request of military authorities, including the triangulation of Eglin Air Force Base, Florida, the Naval Ordnance Proving Ground at Inyokern, California, and the Joint Long Range Proving Ground in Florida. Reconnaissance and astronomic parties are now operating in the Bahama Islands preparatory to determining the exact distance from tip

to tip of both Grand Bahama and Eleuthera Islands. These findings are needed by the Department of Defense in connection with a program for shoran calibration.

The major effort in hydrographic surveying is to accelerate the charting of the vast unsurveyed waters of Alaska but progress is handicapped by the climatic conditions. Since it is impracticable to survey there during a large part of the year, other projects in more southern areas are undertaken during the winter season. Many of these surveys are at the direct request of the Navy.

Processing of geodetic field records in the Washington and New York computing offices—one of the bureau's major functions—has been greatly expedited by the use of punched card methods. One of the biggest office tasks at present is the adjustment of the European triangulation net. Now nearing completion, this project is being done at the request of the Army Map Service to bring the various segments of that net into correct relationship with each other on a common reference level. At the same time a similar adjustment is being made of the Mexican and Central American networks on the basis of data from the Mexican Geodetic Survey and the Inter-American Geodetic Survey.

In cooperation with practically all the other American Republics, Coast and Geodetic Survey observers have completed a preliminary magnetic survey of Central and South America and at present are cooperating with the Inter-American Geodetic Survey in completing such surveys in areas not previously covered. In cooperation with the United States Air Force the bureau is conducting an airborne magnetic survey of the United States and adjacent ocean areas, using a special magnetometer developed by the Naval Ordnance Laboratory.

In the field of photogrammetry, or photographic mapping, several projects for the large-scale topographic mapping of certain areas in Alaska, requested by the Army and Navy, are now in progress. Other mapping projects include surveys to assist in the selection of a suitable site for a new airport to relieve the traffic pressure now borne by the present Washington National Airport in the District of Columbia.

Whether accumulating basic findings on coastal configurations for the safety of mariners and fishermen or preparing a special study that will insure success in some amphibious operation of the future, the Coast and Geodetic Survey stands ready to serve the Nation well—in peace or war.

NORTH ATLANTIC TREATY ORGANIZATION

By

VICE ADMIRAL JERAULD WRIGHT

THE signing of the North Atlantic Treaty at Washington on 4 April 1949 marked the culmination of many months of effort on the part of the signatory nations. As early as the summer of 1948, representatives of the Governments of Belgium, Canada, France, Luxembourg, the Netherlands, the United Kingdom and the United States began conversations in Washington for the purpose of attempting to solve their mutual security problems.

The resulting Treaty is rooted in the common heritage of the peoples living on both shores of the North Atlantic Ocean. Those peoples not only have cultural ties but they also possess an ingrained faith in the dignity and worth of the individual, a belief in the principles of democracy and a profound respect for the rule of law.

Articles 3, 5 and 9 of the Treaty set the stage for the establishment of the combined organization of the member nations known as the North Atlantic Treaty Organization (NATO) which is responsible for carrying out the provisions of the pact.

Article 3 states: "In order more effectively to achieve the objectives of this Treaty, the Parties, separately and jointly, by means of continuous and effective self-help and mutual aid, will maintain and develop their individual and collective capacity to resist armed attack."

Article 5 defines the action to be taken by the member nations should such an armed attack occur: "The Parties agree that an armed attack against one or more of them in Europe or North America shall be considered an attack against them all; and consequently they agree that, if such an armed attack occurs, each of them, in exercise of the right of individual or collective self-defense recognized by Article 51 of the Charter of the United Nations, will assist the Party or

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Parties so attacked by taking forthwith, individually and in concert with the other Parties, such action as it deems necessary, including the use of armed force, to restore and maintain the security of the North Atlantic area.

"Any such armed attack and all measures taken as a result thereof shall immediately be reported to the Security Council. Such measures shall be terminated when the Security Council has taken the measures necessary to restore and maintain international peace and security."

The basis of the North Atlantic Treaty Organization is laid in Article 9 of the Treaty: "The Parties hereby establish a Council, on which each of them shall be represented, to consider matters concerning the implementation of this Treaty. The Council shall be so organized as to be able to meet promptly at any time. The Council shall set up such subsidiary bodies as may be necessary; in particular it shall establish immediately a defense committee which shall recommend measures for the implementation of Articles 3 and 5."

The North Atlantic Council. The senior body in NATO is the Council. The North Atlantic Council as orginally established was composed only of the Foreign Ministers of the Treaty nations. Following reorganization in May 1951, however, the Council membership is drawn from a panel of government representatives on the highest level, depending upon the agenda. Its membership may be composed of foreign ministers, defense ministers or finance ministers and heads of state may appear in person if appropriate.

The Council meets annually in ordinary session and at such other times as may be deemed desirable by the majority of the parties. The location of each session is determined by the Chairman after consultation with the other nations. For general convenience the annual session is normally held at about the same time and in the same geographical area as the annual session of the General Assembly of the United Nations. Chairmanship of the Council is rotated in alphabetical order of nations. The Foreign Minister of Belgium, Mr. Paul van Zeeland, is the present Chairman.

The Council Deputies. Serving the Council as a continuously functioning body on a high political level are the Council Deputies, representatives of ambassadorial rank from each of the twelve NATO countries meeting in continuous session in London. Their permanent Chairman is an American, Mr. Charles Spofford.

When the Council is not in session, the Council Deputies carry out its policy, making recommendations to governments as necessary and formulating issues requiring decisions by the Council or by member governments. They constitute a body which may register the approval of their governments on matters before them for consideration.

The Deputies are also responsible for coordinating the activities of and giving guidance to all other permanent organizations of NATO; they exchange views on political matters of common interest within the scope of the Treaty and promote and coordinate public information activities.

The Council and its full-time working group, the Council Deputies, represent governments on the highest political level. On the next level and responsible to the Council are three agencies—the Defense Production Board, the Military Committee and the Finance Economic Board.

The Defense Production Board. The Defense Production Board is a full-time agency having as its general objective the achievement of the maximum production of military equipment in the most efficient manner, at the least cost and in the shortest time to meet the military materiel requirements of NATO. These objectives will be sought by coordinating national production programs so that they will together fulfill NATO-wide production objectives.

The Defense Production Board, with offices in London has representatives on a sub-ministerial level from all nations participating in the Pact. Mr. William Herod, recently president of the International General Electric Company, is the Coordinator. Mr. William Batt, formerly of the SKF Ball Bearing Company, is the United States Representative.

The Financial and Economic Board. The Financial and Economic Board is the successor to the originally established Defense Finance and Economic Board. It is responsible for considering and making recommendations for the best use of financial and economic resources of member countries in support of the common defense effort. It advises the other NATO bodies under the Council Deputies on all relevant economic and financial questions arising out of their work. The Financial and Economic Board ordinarily addresses its recommendations to the Council Deputies but in specified cases these may be sent direct to member governments. The Board will be located in Paris.

An additional subsidiary committee, the Ocean Shipping

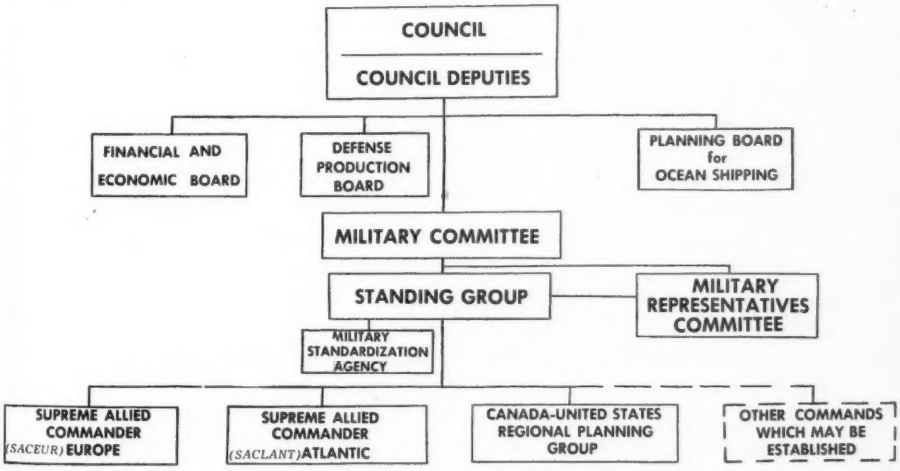
and Planning Board, has the function of planning for the wartime employment of shipping—merchant shipping to meet the economic and military requirements of NATO nations.

The Military Committee. Established by the Defense Committee on 5 October 1949, the Military Committee is the chief military body of the North Atlantic Treaty Organization and is directly responsible to the Council. Its membership is composed of one military representative on the Chief of Staff level from each member nation. Because Iceland has no organized armed forces, it is represented by a civilian.

The Military Committee maintains close liaison with NATO's Defense Production Board, provides general policy guidance to the Standing Group, advises other NATO agencies on military matters and makes recommendations to the Council concerning military measures for the unified defense of the North Atlantic Area. Specifically, this last task requires the development of strategic defense concepts, plans for the integration of forces and integration of regional defense plans.

The Chairmanship of the Committee is held by member nations in alphabetical rotation. General of the Army Omar N. Bradley, the United States representative on the Committee, served as the first Chairman. The present Chairman is Lieutenant General Etienne Baele of Belgium. The Committee meets

NORTH ATLANTIC TREATY ORGANIZATION



ORGANIZATION AS OF 1 JUNE 1951

in closed session and to date has held five formal meetings.

The Standing Group. The Standing Group, established on 6 October 1949, is in effect the executive or steering agent of the Military Committee and is organized to function continuously. For the sake of efficiency it is made up of one military representative each from the United States, the United Kingdom and France.

The Standing Group provides guidance to regional planning groups; coordinates and integrates strategic and logistic planning; promotes plans and studies and recommends policies of a military nature on issues emanating from the regions; reviews and consolidates regional equipment lists; plans for standardization; coordinates with the Defense Production Board and resolves other problems as directed by the Military Committee or as deemed necessary by the Standing Group itself in the name of the Military Committee.

The present composition of the Standing Group includes Vice Admiral Jerauld Wright for the United States (serving as deputy for the United States Representative, General Bradley); Air Chief Marshal Sir William Elliot for the United Kingdom; and Lieutenant General Paul Ely for France. Rear Admiral J. H. Foskett, USN, is the Director in charge of an International Secretariat and staff serving the Standing Group and composed of military officers of the United States, the United Kingdom and France.

Military Representatives Committee. In order to assist and advise the Standing Group in military matters pertaining to the other NATO nations, there is also in continuous session in Washington a group called the Military Representatives Committee, which consists of one military representative of the chief of staff of each nation which is not represented on the Standing Group. By this combination, means are provided for the effective control and direction of NATO military forces.

Regional Planning Groups. So that early and efficient planning of the unified defense of the North Atlantic Area might be facilitated, five regional planning groups have been established. These groups were organized to fit specific needs, with membership so arranged that each participant could make its maximum contribution to the defense of specific parts of the North Atlantic Area.

Each group, established on the basis of geographical, political and military considerations, is organized as follows with its headquarters location shown in parenthesis:

a. Northern European Group (London)—United Kingdom, Norway and Denmark.

b. Southern European-Western Mediterranean Group (Paris)—Italy, France and United Kingdom.

c. Western European Group (London)—United Kingdom, France, Belgium, the Netherlands and Luxembourg. In addition, Canada, Italy and Denmark have been invited to participate as appropriate.

(*Note:* The United States has been invited to participate in each of the above three groups and has consented to do so.)

d. North Atlantic Ocean Group (Washington)—All signatory nations except Luxembourg and Italy.

e. Canada-United States Group (Washington)—Canada and the United States.

These groups are charged with recommending to the Military Committee, through the Standing Group, plans for the defense of their respective regions and for cooperation with other regional planning groups to eliminate duplicating effort and insure harmony among the various regional plans. As of 1 June, the three European planning groups were being phased out and their functions will be absorbed by SHAPE.

At a joint meeting of the North Atlantic Council and the Defense Committee in Brussels on 18-19 December 1950, arrangements were completed for the establishment in Europe of an integrated force under a centralized control and command. General of the Army Dwight D. Eisenhower was appointed to serve as the Supreme Commander of the joint force composed of contingents from the participating governments of the North Atlantic Treaty Organization. Shortly thereafter General Eisenhower established his headquarters—known as Supreme Headquarters Allied Powers, Europe (SHAPE)—in Paris. The SHAPE staff is composed of officers drawn from those nations contributing to the force.

General Eisenhower's headquarters has authority to train national units assigned to his command and organize them into an effective, integrated defense force.

At this same meeting the Military Production and Supply Board was superseded by the Defense Production Board with much broader powers than its predecessor. The new Board is charged with expanding and accelerating production and with furthering the mutual use of the industrial capacities of NATO.

At the Brussels conference, the Council also invited the Governments of the United States, the United Kingdom and

France to explore German participation in the newly formed defense organization.

Relationship with MDAP. The North Atlantic Treaty is in itself a powerful deterrent to aggression by making it clear to any potential aggressor that twelve member nations are determined to defend themselves collectively. Yet the firmest will to defend is ineffective without the power to defend. To help supply that power each member is pledged to contribute as best he can from the resources at his disposal. The Mutual Defense Assistance Program (MDAP), as it relates to the North Atlantic Area, is one phase of the American effort to fulfill its obligations of strengthening the Atlantic defenses.

Although MDAP and the North Atlantic Treaty developed separately, they are complementary. MDAP fits into the Treaty to make it stronger. The North Atlantic Treaty sets forth the principles and provides the machinery for the development of strategic plans for the collective defense of the area. MDAP offers one method of providing the materials to make mutual defense a reality.

The Congress of the United States has recognized American obligations in strengthening the defenses of the free world by three distinct actions in the past year. The original MDAP authorization and appropriation was $1,314,010,000 for fiscal year 1950 requirements; the fiscal year 1951 appropriation was $1,222,500,000 made just before the Korean crisis; and a supplemental appropriation of $4,000,000,000 was passed by the Congress in September 1950. Nearly 85 per cent of this 6.5 billion dollars was earmarked to help bolster the defenses of Western Europe. The balance goes to the geographical areas of the Near East and the Far East.

The organization for the Mutual Defense Assistance Program in the United States calls for close interdepartmental coordination between the Department of State, Department of Defense and the Economic Cooperation Administration. At the top level these three participating agencies coordinate MDAP activities through the Foreign Military Assistance Steering Committee composed of the Secretary of State (who serves as Chairman), the Secretary of Defense and the ECA administrator. Similar interdepartmental coordination characterizes the efforts of those on the working level, both in the United States and overseas, to guarantee the fullest and most efficient employment of MDAP funds in the support of the North Atlantic defense effort.

A YEAR IN KOREA

Twelve months of conflict in Korea have seen the emergence of a battle-tested force united in its determination to strike telling blows for the defense of free men and ideas. War in Korea has many facets. These are but a few showing our unified fighting machine in its drive for victory.

Waiting is part of the battle — In the early stages of the Red advance, a tank commander watches for enemy planes . . . Wary infantrymen protect their trans-river lifeline.

There are casualties in men and materiel — Wounded Marines reach a forward aid station . . . Mud takes command of the battlefield.

Supply and demand — Air transports work around-the-clock to get materiel to the front . . . A 75mm recoilless rifle team makes good use of its weapon.

An amphibious thrust outflanks the invader — LSTs back up beachhead operations . . . Marines scale the seawall at Inchon harbor.

Some, not many, Reds give up the fight voluntarily — A North Korean (above) . . . Chinese Communists (below).

Attack from the sea — Corsairs from Navy Task Force 77 prepare for take-off . . . Naval guns find an east coast target.

Retribution, off-the-shoulder style — A B26 crewman wears a scarf of fire-power for use against the Communist foe.

(All photographs in this section by Department of Defense agencies.)

THE RACE FOR PEACE

By

THE HONORABLE EARL D. JOHNSON

Assistant Secretary of the Army

AMERICA today has entered a race for peace—the most crucial race in our history. It is not an armament race in the context which history has repeated for us again and again but a race whose finish line represents the achievement of such overall strength that we will attain peace as we know it and want it. It is a race in a very real sense for we must achieve our strength before the time remaining to us to win expires. In the past, this precious element of time has been bought for us by our allies. Because of their proximity to potential sources of danger, these nations previously built up and maintained a military posture which permitted us to rely on them to absorb the first shocks of battle. This in turn gave us the time to mobilize our vast manpower and production potentials before war actually struck our shores.

But the day which permitted such reliance on others is gone. In Korea we found that we had to fight from the start. Within a week after the issue was joined, our ground forces were involved.

All agree the danger is grave. In this race every hour counts. How do we prepare? How do we organize? How do we win this race for peace?

An analysis of our past preparedness programs indicates that the greatest amount of time has been consumed in mobilizing our production potential. Therefore, our first effort in the long-range program has been to establish a production base capable of explosive expansion if war should strike.

In this race, the first lap has been devoted to the analysis and procurement of production facilities and equipment needs. The decision has been to reduce to a minimum any stockpiling of finished items of equipment which will become obsolete in a relatively short period of time. We are stockpiling,

From an address before the Association of Commerce, Milwaukee, Wisconsin, 14 May 1951.

not end items, but production facilities. We are attempting to build a system of such facilities, assembly lines and basic transportation systems which can be dynamically expanded should the necessity arise.

Our opponents in this race are the Red leaders of Communism. In their bid for world domination these dictators in the Kremlin have at their disposal huge masses of manpower. That is their strength. Their weakness is their limitation of production facilities. This is an enormous weakness, for it means that they lack the capital plant both to equip and continuously supply their vast manpower resources. Their only solution and the one they have had to resort to is stockpiling of supplies on a large scale over a number of years. However, by such stockpiling the Red Communist leaders have had to freeze into being those designs which they determined to be best at the time production began. Lacking sufficient production capacity, they cannot take full advantage of subsequent technological improvements we know they have made.

Our situation is almost the reverse. Manpower, in contrast to that of the Red Communist world, is one of our shortages. But we do have mass production—a relatively enormous capital plant. In the past we have employed our production facilities as one step in a continuous process of moving materials from the raw state to the finished item at the battle front. Planes and ships and weapons have been moved right out of the assembly lines into the front lines. In fact, one reason World War II's end did not find us with as large a stockpile as many people expected was because we expended as we produced.

Large as is our capital plant, not all of it by any means can be devoted to production of defense items. Since we may not have the time either for conversion or new construction, we are wisely stockpiling such facilities.

We have had to tailor the execution of our facility stockpiling to meet possible atomic war. This has thrust upon us costs which we would like to avoid. For instance, it would certainly be less costly to procure all of our tanks from one highly specialized, economically located assembly line. However, we cannot accept the risks which interruption of that line would involve. We have had to plan on securing, say, 100 tanks from each of ten lines—uneconomically dispersed—rather than 1000 from one line. The cost naturally is greater this way; we have knowingly accepted that added cost.

In the past our planning was geared to the idea that we had free access to the raw materials of the world. Our strategy was linked to the belief that through our dominant naval power we could hold the sea lanes open. However, twice in this century America and her allies have been on the brink of disaster through the havoc wrought by enemy submarines. Today, with air power in the ascendency, it would be unsafe to plan too complacently on keeping the highways of the sea open. Therefore, we are stockpiling those items in which we know critical shortages will arise.

In a limited way we are also stockpiling certain finished goods. Even here, however, we are attempting to break down particular items according to their component parts, stockpiling only such components as require an unusually long time to fabricate or which require production facilities and industrial "know-how" of a very specialized type.

Because of the premium placed on time in any race, we have found it necessary to telescope the research and development phase of a new item with its production phase. Normally, these steps occur in sequence. We cannot now afford to wait for the perfectly tested item; knowingly and purposely we are placing into production a whole host of new items with the full awareness that we may have to modify them later. This proved of real value in World War II, particularly in the modification of aircraft to the rapid advance of aeronautical science.

Fortunately for us, America has the industrial genius and plant capacity not only for accomplishing the initial production but also for continuing the research and development and establishing modification centers. In this manner we are attaining a potential level of advanced armament at a remarkably early date. The Army alone has standardized 321 items since the beginning of the Korean conflict and contemplates adding 268 more by the end of the 1952 fiscal year.

In the second lap of our race for peace we are concentrating on the mobilization of our Nation's manpower into a force capable of turning back any overt aggression now or in the future. We realize that we have begun this lap with a distinct numerical disadvantage. The Joint Senate Committee on Foreign Relations and Military Affairs recently issued a statement in which they estimated the total strength of the armed forces of the North Atlantic Treaty nations, including the United States, at four and one-half million men. The total of the Soviet Communist force, including that of its

satellites, China excepted, is estimated at five million. There are at least another five million in China. This is a total force under arms double that immediately available to the free world.

We cannot hope to match this numerical superiority. To offset it we must establish a sufficient base of trained men in this country which, together with our industrial might, will give us the overall defensive superiority necessary to win.

Nobody questions the need for a pool of trained or semi-trained men. That need has been proven. The question is: How do we achieve such a reservoir?

In developing our manpower goals we must achieve a system that can be supported over a protracted period of time, a system which will permit a fresh inflow of personnel as well as a necessary output. The long-range aspects and needs of such a preparedness program are perhaps the most difficult elements for us to appreciate. Our entire philosophy of existence, our cultural traditions, our social customs—all cry out against any involuntary military service short of total war. We abhor the thought of forcing our youth to study the science of destruction, to contribute some of its golden years to learning war. But if we are to survive, that price must be paid.

The first step in our program of manpower mobilization is the creation of a competent force, strategically located, to prevent disaster and to retaliate immediately if we are attacked. The Joint Chiefs of Staff have recommended a total strength of approximately three and a half million men as the minimum to achieve this objective.

At the same time, we are taking inventory and evaluating the reserve components of the respective services, including the National Guard. Where it is considered desirable, we are reorganizing and realigning these civilian components in order to attain their maximum effective utilization in terms of the different types of crises we may face in the future.

After achieving a force in being and aligning the reserves properly, Universal Military Service and Training is the final essential step in manpower mobilization. This plan is sound from the standpoint of the Nation and from the viewpoint of the individual young man. It would place virtually every physically and mentally fit young man under the obligation of contributing to national security by beginning a period of military service and training when he is approximately 18 years of age. Upon conclusion of his active duty or training,

he would serve a specified term in some civilian component. At the same time, he could resume his education or take a job and fit himself into the normal pattern of civilian life. This plan would insure that the country would always have the necessary reservoir of trained and semi-trained men. With these men, when the need arises, we could immediately increase and expand our fighting forces to the extent required. The time saved would be priceless.

Integral to our planning is the mobilization scheme of our potential allies. We are participants in the North Atlantic Treaty and the Mutual Defense Assistance Program. We propose to join in strengthening the defenses of Western Europe. We are making every possible effort to secure a prompt and just Japanese peace treaty. The security arrangements we have entered into with the free nations of the world stem from our realization that our national security is completely dependent upon the security of other free nations. Two wars have taught us that these nations need our help and we need theirs. Never before has this been more true than now; for never before has the free world been challenged by such a powerful, insidious and ruthless force as Red Communism.

We are in a period where the danger is heightened because of our lack of preparedness. If we have hope of deferring a war, and everyone is proceeding on the basis that war can be avoided, that hope lies in a strength which will deter aggression. Only in the face of such strength will the aggressor realize that his cause is futile.

PARACHUTES ALOFT

By

FLYING OFFICER EDWARD J. HUDSON

THE breeze wafts the seed away on its parachute of down; the seed drifts to earth and another dandelion beachhead is established. From Icarus of mythological days to the Wright brothers of the machine age, men have been fascinated by the flight of birds, the effortless soaring of gulls and vultures, the mechanics of seed dispersal and other miracles of nature. Attempts to emulate them have led to innumerable fiascos, it is true, but at the same time these efforts have brought to light changeless principles of enduring scientific value.

Man's search for something to amuse himself and others led him to develop a type of parachute in the early fourteenth century. It was not the type with which we are familiar today nor did he have an easy way to get it into the air. He lugged his parachute up the stairs of Chinese pagodas, then jumped, performing acrobatics on the way down to induce his fellow countrymen to loosen their purse strings. This spectacular feat was introduced to Europe where it was presented as a method of escaping from burning buildings.

In the course of demonstrating their aeronautical theories, the eighteenth century Montgolfier brothers put a thoroughly frightened sheep on a parachute and let it drift to earth from the top of a Paris tower. Another Frenchman used a parachute 14 feet in diameter to reach the ground from a tall building.

Interest in this type of spectacle waned, however, as people turned their attention to the balloons drifting over the towns and cities. Jacques Garnerin achieved fame by parachuting from balloons and even the King of England invited him to put on a display. Garnerin ascended to a height of some 8000 feet with his parachute attached to the basket of a balloon; he cut the ties and started down. The amazed, then anxious crowd saw him swing violently from side to side with ever increasing rapidity. He was badly shaken as he hit the ground

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and the oscillation during descent was the subject of heated debates as to its cause and remedy. The armchair experts of the eighteenth century had a field day until a French scientist suggested making a vent at the top center of the canopy to allow the escaping air to go straight through instead of leaving around the skirt.

Soon descents from balloons became so common that the parachutists had to resort to the original Chinese stunt of doing acrobatics on the way down. In the nineteenth century, circuses throughout the United States had their displays of daring parachutists, both men and women.

New thought was given to the parachute when the Wright brothers successfully flew their airplanes. A collapsible type parachute had been invented by Captain Thomas Baldwin, but arguments arose as to whether man could stand the effects of bailing out at such "terrific speeds." This was answered in 1911 when Grant Morton jumped from an airplane over Venice Beach, California. Headlines told how he carried the canopy of his chute under his arm and threw it out after he left the plane. There was no parachute pack in those days.

It took a full-scale war to add impetus to the development of the parachute. In World War I, hundreds of balloon-borne aerial observers were saved by taking to their silk canopies. Aviators, however, did not take kindly to parachutes. To some the idea of wearing a parachute was evidence of a lack of faith in one's plane. Many aviators lost their lives in leaps from burning or disabled planes until concern over these losses prompted the British to introduce the "Guardian Angel" chute for its airmen in 1917. This chute was designed to be opened by a static cord attached to the aircraft but it had its defects. Sometimes the static line either pulled the chute open too soon, letting it foul in the tail of the plane, or the line broke and failed to open the chute. The Germans tested a similar type with the added feature of a pilot chute opened by a static line. The Americans were experimenting with their own types of chutes when World War I ended.

The war over, air crews went home and planes rotted and rusted. Fortunately, research in the problems of parachute design continued in developments and experiments at McCook Field, Dayton, Ohio. At last in 1919 a self-released chute was ready for test. Leslie Irwin was the first man to pull a rip cord on the way down. This rip cord system of parachute release is the one generally in use today. In the Battle

of Britain alone 85 per cent of the fighter pilots who were shot down saved their lives by this type parachute.

The modern-type parachute consists of four main parts—the canopy, the suspension lines, the harness and the pack. In addition there is a combined trigger and opening mechanism (or pilot chute) in all parachutes opened by a rip cord.

The main part of a parachute is the canopy, which in a standard parachute 28 feet in diameter is constructed of 28 triangular panels of silk or nylon. Each of these panels is constructed of four smaller panels with cloth cut on the bias so that the threads make an angle of 45 degrees with the center line of the panel. Thus any run starting in the panel is brought to a halt upon reaching the double stitched seam. Cutting on the bias also increases the elastic properties of the assembled cloth, enabling the canopy to withstand the shock of opening.

The diagonal double-stitched seams joining the four sections of each panel are overlapped in such a manner as to give four layers of cloth with the raw edges hidden inside the fold. At the point where the main panels are sewn together there is a stitched channel through which runs the suspension line (often referred to as shroud line). Points where the shock of opening exerts its greatest strain are reinforced—at the base of the canopy, at the vent in the center of the canopy and at points where the suspension lines cross over. Zig-zag stitching permits a certain amount of stretching without breaking. The canopy is further reinforced with strong nylon tape around the vent and the skirt.

To attach the canopy to the harness, the suspension lines are divided into groups which are tied to two D rings. These in turn are attached to the free ends of the harness webbing (called "risers"). The harness itself is strongly made of cotton or nylon webbing. All cut ends are treated with paraffin, then turned under and stitched to prevent any possibility of fraying. In effect, the harness forms a swing in which the wearer sits during his descent. A quick release mechanism is used by a paratrooper to disengage himself readily from the harness before entering battle.

A few seconds after bailing out from a plane, the parachutist pulls the rip cord. The actual opening of the main canopy is accomplished by a pilot chute which is attached to the suspension line at the center of the canopy by a strong cord. This little chute, only 36 inches in diameter, is opened

by four steel ribs which are forced open by a compression spring as the rip cord pulls the safety pin out of the pack.

The paratrooper taking part in a mass jump has his main chute line fastened by a snap to a steel cable in the plane. His auxiliary chute, however, has the pilot chute mechanism.

The folded canopy is carried in a pack adapted to the work in which the wearer is engaged. The seat type pack is generally worn by fighter pilots who have neither room nor time to put on any other type of chute before they bail out. The chest pack is worn by navigators and crewmen who have to move about considerably while working in the aircraft. Their harness is worn continuously while in flight and the pack can be attached almost instantly in an emergency.

There are also two types of back packs—one flexible, the other the standard type used by paratroopers. The flexible type is generally worn by those who push cargo out of planes. It allows considerable freedom of movement but is immediately available when, as sometimes happens, the pusher loses his balance and goes overboard with the cargo. Commercial airlines are introducing still another type of pack—one that fits into a chair. It looks neat, is comfortable to sit on and is right there if needed.

The employment of paratroops for mass assault was advocated as early as 1918 when Brigadier General William Mitchell of the United States Army proposed this technique as a means of "climbing over the Western Front." However, he was not able to test the idea until 1929 when he arranged to have a lieutenant and six men drop from a plane over Kelly Field, Texas. The men assembled quickly, set up the machine gun dropped with them and were ready for "action."

Russian officers employed this technique in the 1930 maneuvers when nine men jumped to capture the headquarters of an army corps. Specialized small units were trained to drop behind the enemy lines to attack and secure airdromes and bridges. Foreign military observers at the 1936 Soviet maneuvers beheld whole battalions of Red troops dropping from the sky. But this was just one phase of the large-scale training carried on in Russia.

To Russian civilians this was mere routine for they too practiced parachute jumping. A civilian organization called *Osoviakhim* was set up throughout the Soviet Union to advance the sport of jumping from the more than 500 towers built for the purpose. By 1939 estimates of the trained Soviet

parachutists ran to two million—a potential force whose military value was not overlooked by the Germans and Italians who watched closely.

The Italians supplied some of their troops in Ethiopia by parachute. In the Spanish Civil War, German paratroopers fought against Russian trained paratroopers. Twenty-one survivors of the fifty German paratroopers who participated returned to Germany to set up a parachute academy.

Anticipating the need for paratroopers, the United States set up an official paratroop training center at Fort Benning, Georgia, in 1940. Familiarization jumps were carried out from a 250-foot tower. Here Canadians also were trained before returning to Canada to set up their own program.

The parachute served to introduce a third dimension to military tactics in World War II. The large-scale Normandy invasion was preceded by mass parachute drops by the British 6th and United States 82d and 101st Airborne Divisions. Later the First Allied Airborne Army—consisting of the British 1st and United States 82d and 101st Airborne Divisions—struck at Eindhoven, Nijmegen and Arnhem in Europe, while in the Pacific, paratroop landings played an important role in the liberation of Corregidor and other islands.

Both sides used the parachute to drop agents behind the enemy lines and to supply guerrilla forces. Planes from secret airdromes in the Middle East droned through the mountain passes of Yugoslavia seeking the signal lights on which they dropped agents and supplies. Not all trips were as silent and as unpublicized as these. A familiar phrase recurring in communiques throughout the war was "Parachute mines were laid in enemy waters." Parachutes slowed the descent of "block-busting" bombs to permit the carrier planes to escape the area of concussion.

With the advent of modern jets traveling at near sonic speeds, special devices have been invented to protect the airman from the initial shock as his parachute opens in the onrushing slipstream. To overcome this problem, modern jets may be equipped with a capsule compartment for the pilot which is fired from the plane by a gunpowder charge when he presses a button. Once the capsule is clear of the plane, a drogue chute opens which slows the capsule down and also pulls the main chute out. The pilot floats to earth in his own private compartment.

Research shows that an airman leaving a jet at 600 miles

an hour will slow down to a mere 120 to 135 miles per hour in about six seconds. To overcome the lack of oxygen and the extreme cold at rarefied levels, it is desirable that the opening of his chute be delayed until he has fallen to a reasonably safe altitude of about a mile above the earth.

In a recent test near Holloman Air Force Base, Alamogordo, New Mexico, Captain Richard V. Wheeler, USAF, jumped from a height of over eight miles to test a device that automatically opens the chute upon reaching an altitude where there is sufficient oxygen to live. This automatic parachute opening device, developed in the USAF Equipment Laboratory of the Air Materiel Command, operates on an aneroid cell which actuates the chute opening mechanism when the airman has reached a certain pressure level or altitude. If the bail-out is made at high speed and low altitude, the automatic release provides a five-second delay which allows the pilot to clear the aircraft and slow down to a safe speed before the parachute opens.

Several types of experimental parachutes have been developed to answer the need for a chute that can be opened quickly without causing serious shock to the wearer even at speeds of several hundred miles per hour. During World War II the Germans experimented with a ribbon-type chute but this had the disadvantage of not slowing the man enough before the ground stopped him permanently. This type has been found useful however in slowing the landing speeds of fast aircraft and in preventing aircraft spins.

A square ribbon parachute, recently developed by the United States Air Force, has proved its utility in heavy cargo and equipment drops. The 28-foot square chute is formed by nine strips of cotton material attached by cotton tapes. The space between the cotton strips allows for fast escape of uprushing air and thus minimizes the opening shock. The new chute will permit aerial delivery of about 500 pounds of cargo as contrasted with the 300-pound capacity of ordinary parachutes.

Another type of chute is made of undrawn nylon whose elastic properties allow it to stretch with the shock of opening. Still another type has a center canopy fastened to the main one by elastic bands, so contrived that the shock of opening allows air to escape between the canopies. This latter type has its limitations because rubber is brittle at low temperatures.

The capacity of the parachute for service in peace or war is apparently limited only by man's ingenuity and skill in

providing the aircraft to dispatch the loads. During Operation Swarmer in North Carolina in the spring of 1950, ¼-ton trucks and 105mm howitzers were pulled from C-119s by drogue chutes, then lowered safely by clusters of parachutes. (See "Swarmer—Pattern for Airborne Assault," July 1950 DIGEST.)

Personnel of parachute maintenance companies serving with airborne divisions have an exacting task keeping the aerial lifelines in top condition. Each parachute is inspected thoroughly and repacked every thirty days in the Canadian forces, every sixty days in the United States. The technicians who do this work are highly trained and experienced. As part of the inspection process, each parachute is hung in a "well" or tower of sufficient height to permit the canopy and suspension lines to hang freely for airing. Airing takes at least 24 hours. The parachute is then laid out full length on a long narrow table to provide easy access for the workers on either side. Here all the stitching and fabric is examined for discoloration, fraying or tears. Tears up to one-quarter inch in diameter may be darned; but chutes requiring more extensive repairs or replacement of damaged suspension lines in the past have to be returned to the manufacturer. After thorough inspection the parachute is folded and packed.

The packing is done according to standard procedure. Each panel is examined, folded neatly, then held flat by a bag of lead pellets. The suspension lines are packed first into loops in the back of the pack, followed by the canopy and the pilot chute. As the packing is completed a thread is slipped through the lead seal pellet at the end of the rip cord to indicate that the parachute has been checked and packed.

Parachutes in storage are normally checked and repacked every sixty days. Regular packing keeps life in the fabric so that, with proper care, a parachute can be used for a period of eight years before it is "retired" to cargo-carrying service.

In the Arctic the parachute may find its kingdom, for the transportation problem there is still unsolved. Several successful experiments have been carried out in the northland using the parachute as the chief means of supply. The Russians have used the parachute for years in dropping supplies to their northern outposts. The Wood-Yukon expedition of 1941 relied on parachuted supplies; and Operation Musk-Ox further tested the effectiveness of supply dropping on the tundra.

Increasingly the parachute is becoming known as an in-

strument of emergency rescue and disaster relief. The news of recent years abounds in accounts of parachute drops of plasma for the injured and of antitoxin to combat epidemics in isolated villages. Physicians and rescue teams have dropped into the wilds to administer first aid and lead the lost to safety. (See "Rescue By Air," February 1950 DIGEST.)

The "Smoke Jumpers" who leap to the scene of remote fires are a unique breed of parachutists whose mission is the preservation of timber preserves. Their experiments began in 1939 in the rugged Chelan Forest area in the state of Washington. As an aid in this work, a steerable type parachute was developed by Buster Derry, one of the first smoke jumpers. This chute has openings in opposite panels which allow the air to slip through. By closing one of the apertures, the parachutist can gain a forward or backward speed of five miles an hour while steering himself to the scene of remote fires.

The canopy of silk which was originally an amusing Oriental innovation and a novelty at the county fair is today an important factor in military strategy and logistcis. It has brought food to the hungry, rescue to the lost and medical care to the sick and injured. Its fabric has provided the white dress for many a wedding; the canopy a shelter for a foxhole. Today in Korea it bears men and supplies earthward to stem the tide of Red aggression. In a multitude of ways, it is the connecting link between the airborne and the earthbound, carrying the men and materials that make possible the liberating armies' advance.

On the defensive in air warfare we are like a batter with two strikes against him. We have to swing at everything that gets close. We hope to hit. But in air warfare, as in baseball, the batting percentages favor the pitcher. Most of the strikes get by.

Defense against air attack is important and it is absolutely necessary. But it cannot win. In any kind of struggle from fist-fights to jet bombers it is not the deflection of a blow that brings victory; it is the blow delivered that wins.

General Hoyt S. Vandenberg

U. S. Navy Photograph

Part of the mothball fleet at the Philadelphia Naval Base. Dome-shaped objects on the decks are igloos used for preservation of materiel. Below, seams inside an igloo are given a final tightening. The flexible hose circulates dry air throughout the protective hut.

REVITALIZING THE MOTHBALL FLEET

By

LIEUTENANT COMMANDER GUY MOON

THE wisdom of stockpiling is as old as the Bible story of Joseph advising the Egyptians to preserve huge stores of food against the coming famine. The United States Navy did very much the same thing when, under the impact of demobilization, Operation Mothball was put into effect. Today the greatest naval preservation program of all time, begun 30 January 1946 in the Philadelphia Naval Shipyard, is paying off in terms of economy, conservation of strategic materials and, most important of all, in meeting immediate needs.

The end of World War II found the United States with the most powerful fleet any country had ever possessed. As far back as 1943, a few strategists in all three services were expressing the need for a thoroughly planned conservation program—a proposal that bore fruit for the Navy in Operation Mothball. This foresight is largely responsible for the favorable naval strength enjoyed by the United States today.

Organizing the Atlantic and Pacific Reserve Fleets for their long hibernation was simple. Strategic points on the Atlantic and Pacific seaboards became the rest-homes of some 2000 battle-weary ships ranging from tugs and landing craft to huge battleships. When the program was completed, 17 groups had been assembled on both coasts. Sea Frontiers, high echelons of command outside of Navy Department headquarters, assumed the responsibility for their maintenance.

The first major vessel to go into mothballs at the Philadelphia Naval Shipyard was *USS Brooklyn*. The methods devised there served as the model for the preservation of all Reserve Fleets.

As the first step, every perishable store such as batteries and combustibles was removed. Then every piece of equipment

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U. S. Navy Photograph

Crewmen demothballing a battleship check the packing of a 16-inch gun's slide extension.

was carefully scrutinized and restored—or replaced when necessary. The ship's entire table of allowances (except for perishable goods) was completely filled. With this preliminary work done, the whole ship was given a thorough cleaning to remove every particle of dust, dirt and rust from metal surfaces. These preparations on a fleet-wide basis proved to be a key factor in speeding reactivation.

The ship's water-tight compartments were given a final careful check by air-test. Then a rust preventive compound, developed by research experts at the Navy's Preservation School, was applied to all metal surfaces. This is a new wax-like preservative, unlike the older grease compounds which were time-consuming to remove. The new preservative is more effective in preventing oxidation, and motors, pumps and engines coated with the compound can be operated without removing the film. About ten gallons of this compound, at a cost of 75 cents a gallon, will care for an average ship.

As a final step, all openings such as doors, vents and valves in each compartment were tightly sealed. Now the ship was ready for the dehumidifying machinery to be installed. This machinery, working like a gigantic set of lungs, expels the moist air from each compartment, passes it over silica gel and returns the dried air to the compartment. Silica gel is a very efficient salt-like desiccant. It is self-renewing since

the moisture it accumulates can be expelled by heating. The whole process is automatically controlled by the use of humidostats—delicate instruments activated by human hair that responds to the slightest changes in the moisture content of the air. Laboratory tests have demonstrated that a piece of brass which normally would corrode overnight in moist climates will remain brightly polished for 10 to 15 years in the sealed vaults of a mothballed ship. (See "Long Term Storage Proves Its Worth," January 1951 DIGEST.)

In addition to dehumidification and application of rust preventive compound, plastic strippable film and hot plastic paint are employed. These materials take on a rubbery texture when exposed to the open air; and five applications of the liquid will create a moisture-proof package which can be shaped to contours of any large object. Coverings were built for such equipment as gun turrets, guns and other topside gear too large or cumbersome to be taken below decks for storage. Igloo-shaped cocoons—made of metal or fabricated by a spray gun over a mesh of cloth strips—were often connected to a dehumidifying machine to share the same protecting stream of dry air that was used for keeping the below-decks compartments free from the ravages of moisture.

Hot plastic paint was applied also to hulls. Mixed with poison, it kills barnacles or other sea life that cling to

U. S. Navy Photograph

Used preservation equipment is re-crated and stored at the Philadelphia Naval Base for possible future use. In the background are assembled igloos, also held in readiness.

U. S. Navy Photograph

This automatic dehumidifying machine protects areas below decks from the ravages of moisture and corrosion.

ships' bottoms. This new preservative—also used for active fleet ships—will protect inactive vessels for about five years. From stem to stern, from radar antennae to keel, not an inch was overlooked in laying up the ship for its period of suspended animation.

Once the order is given to reactivate, the nucleus of a crew reports aboard and immediately begins unsealing vents, ports and hatches. Ventilating systems and fire mains used in dehumidifying the interior are restored to normal use. Long-necked cranes pluck away the igloos and film tents that protected the topside gear. The sun gleams on well-polished surfaces, indicating that the deactivating crew did a proper job. Turrets are exposed and all over the deck area are signs of new life returning to the ship.

Below decks in the engine room, huge casings housing the reduction gears which tie the power plant to the propeller are drained of their preserving fluid, then carefully flushed and filled with lubricants. Valves are prepared for operation. Bags of silica gel placed where the dry air could not circulate are removed. New gaskets are applied to openings of tanks which then are ready for ballast, fresh water, lubricants, fuel or whatever they may store.

The ship's boilers are fired and her engines are turned over. The vessel is just a few days away from a trial cruise at sea where every device is tested under actual sea conditions. So far, in all of the 381 ships that have been reactivated, only minor defects have been found. There has not been a single instance of any serious breakdown in these oldsters enjoying a second lease on life.

In the period between 1946 and 1951, some $213,000,000 was expended for inactivation and maintenance of the Reserve Fleets. For this amount 2036 vessels, originally costing over 12 billion dollars and which today would cost more than double that amount to replace, have been preserved against a day of need.

The greatest preservation program of all time is paying off. During the recent Hungnam evacuation in Korea, one-third of the fleet which took off 105,000 men plus their materiel were ships which only a few months previously had been standing by in mothballs. The more than 1700 vessels still remaining in the Reserve Fleets can go for another five years before any great amount of work will be necessary to preserve them further. In long rows they move in unison to the ebb and flow of the tides—battleships, cruisers, carriers, hospital ships, destroyers, tenders, smaller vessels—all meshed in their cocoon-like coverings. Passageways and living compartments that once echoed with the life of a closely confined crew are empty and silent now. Only the whirring fan of the dehumidifying machines or the occasional footfall of an inspector breaks the silence. They may be asleep, but like their sister ships already returned to duty, they are ready to spring to life when the need arises.

The art and science of logistics—of backing up front lines with services and supplies—may lack the glamor of duty at the front but they are equally worthy, honorable and indispensable.

The Honorable George C. Marshall, Secretary of Defense.

SCIENCE SEEKS THE TARGET

By

ORIN P. GARD

THE word "aeroballistics" is derived from the words aerodynamics and ballistics. Aerodynamics itself is a new branch of science concerned with the development and control of very high speed aircraft. Ballistics, on the other hand, is an older science dealing with the path, velocity and impact of projectiles. While supersonic airspeeds of projectiles are not new, most of the recent advances in ballistics have been made possible by the application of aerodynamic research to the motion of projectiles. Thus, aerodynamics and ballistics have much in common; in fact, aerodynamic investigations have been accepted as a fundamental part of ballistic research.

The Air Force installs guns, rockets, bombs and guided missiles on aircraft and provides the equipment necessary to direct these weapons at the target. Each weapon possesses its own peculiar flight characteristics and yet the behavior of each type of weapon and ammunition must be known in order to achieve maximum effectiveness in combat. It is here that aeroballistics makes an important contribution.

Studies of flight characteristics are divided into two phases—exterior ballistics dealing with the motion of the projectile after it leaves the launching device and terminal ballistics, concerned with the behavior of the projectile when it reaches the end of its path; that is, when it strikes the target. The exterior ballistic characteristics of the projectile are largely responsible for the ease or difficulty of making a hit on the target. These characteristics also influence the damage that will result when the target is hit.

Highly complex laboratories and outdoor firing ranges are required to obtain all the necessary ballistic information. In high-speed wind tunnels operated by the services, the various

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aerodynamic coefficients of projectiles of various shapes are investigated to advance the science of weapon design and use. The Army Ordnance Corps has one of the world's outstanding ballistic ranges, instrumented for aerodynamic measurements. One of the Navy test stations has a high-speed moving platform for launching projectiles in various directions and determining their motions along the trajectories. The Air Force has its proving ground, test ranges, guided missile range and special laboratory facilities for the measurement, analysis and evaluation of aircraft weapons and armament systems including guns, rockets, bombs, guided missiles and the control equipment required to direct the weapons to the target. Facilities of the Army, Navy and Air Force are used jointly by the three services in carrying out their mutual mission of defense.

Guns

The ballistic properties of projectiles fired from guns on modern high-speed aircraft present many problems in the design of guns and ammunition—problems which impose severe restrictions on the tactical use of aircraft and in some instances even influence the decision whether there shall be many guns, few guns, or no guns on aircraft.

A bullet must be stable in its flight if it is to have a predictable point of impact. Stability is the factor which keeps the bullet from tumbling; that is, from turning end-over-end and consequently losing range, accuracy and ability to inflict damage even if it should strike the target. Spin is imparted to a bullet in order to give it increased stability. Stability, however, is affected by the speed of the aircraft. Thus a bullet may be stable when fired from a gun on the ground but may be unstable when fired from the same gun on a moving aircraft. Then, too, a bullet may be stable when fired from an aircraft at one altitude but may be unstable when fired in the same manner from the aircraft at a different altitude. Desirably, the gun and bullet should be designed so that the bullet will be stable under all conditions.

The question is sometimes asked, "Will the jet airplane catch up with its own bullets?" If an airplane at rest on the ground fired its guns approximately vertically upward, it would be theoretically possible for the bullet to strike the airplane when the bullet returned. However, the force of the variable wind and the normal dispersion (or scatter) of the bullet pattern during the relatively long time and distance of travel of the bullet would practically eliminate the likelihood that

the bullet would strike the airplane. If the gun were fired when aimed upward and forward with the airplane in flight at high speed, it would again be possible, although highly improbable, that the airplane would arrive at the precise point at the right time to be hit as the bullet descended.

If the bullet is fired forward from a jet fighter at high speed at low altitude the projectile will reach a range of approximately 1500 yards in six seconds; then, for an instant, when the bullet's velocity becomes equal to the speed of the airplane the bullet will remain motionless with respect to the aircraft. As the bullet slows down due to air resistance, the airplane gains on the bullet and passes it at a relative speed of a few hundred feet per second. This would occur about the time that the bullet has been in flight for 20 seconds and has traveled 6000 yards through the air. For all practical purposes, the likelihood of the airplane overtaking its own bullets and suffering damage from them can be neglected. In the case of an abused gun firing unstable bullets at lowered muzzle velocity, however, the likelihood might be increased.

A more important question is, "What is the effect of high speed on the effective range, striking velocity, time of flight and accuracy of the bullet when fired forward or rearward at another aircraft?" First, consider a jet fighter at high altitude firing at a high-speed jet bomber, approaching head-on. The high speeds of approach increase the striking velocity and the rarefied air has little effect in slowing down the bullet with the result that, neglecting the fall of the bullet due to gravity, a bullet fired at a 40,000-yard range would travel for a minute and strike with sufficient velocity to penetrate light armor. To penetrate heavy armor the maximum range would be 15,000 yards and the time of flight of the projectile in the rarefied atmosphere would be 15 seconds.

To penetrate light armor in the denser air of low altitude the maximum range would be 8000 yards and time of flight 12 seconds. To pierce heavy armor of an airplane flying at low altitude, the maximum range would be 3000 yards and the time three seconds. At these long ranges and times of flight such factors as the errors of the gun director or fire control system, the dispersion of the bullets, the large gravity drop and the opportunity for the target to maneuver would render the weapon useless. Nevertheless, for head-on approaches the ballistics are adequate to insure penetration when the target is hit.

In a second instance, consider the same bomber, armed with the same weapon, defending itself from the same jet fighter attacking from the rear. In this type of tail defense of high speed bombers it has been found that the ballistics are adequate to insure penetration of the target when it can be hit, with the possible exception of heavily armored aircraft approaching from the rear at low altitude.

In still another case, consider the same jet fighter armed with the same weapon, attacking the same jet bomber from the rear. To penetrate light armor at high altitude the bullet could be fired at 3500 yards maximum range and travel for as much as five seconds. To penetrate heavy armor at high altitude the maximum range would be 2000 yards and the time two and one-half seconds. For light armor at low altitude the maximum range would be 700 yards and the time one second. To penetrate heavy armor at low altitude the maximum range would be 400 yards and the time one-half second. Thus, for low-altitude fighters the ballistic properties are not adequate to insure penetration sufficient to cause serious damage or destruction to the aircraft or its crew.

To overcome or avoid the limiting effect of atmospheric resistance upon the projectile, the muzzle velocity or the size and weight of the projectile must be increased. After a weapon and ammunition combination has been obtained that will have sufficient penetrating ability, the terminal ballistic properties can be further improved by adding to the projectile high explosive or incendiary material that will tear the target structure apart or cause the fuel or other inflammable components of the target to burn. Of course, larger projectiles and larger guns add weight and drag penalties to the airplane. At high air speeds large turrets and protruding weapons place restrictions upon the performance of aircraft unless they are designed and mounted in the most efficient manner.

Aerodynamic penalties generally arise when the airplane is designed first and armament "stuck on" later. To achieve an aerodynamically efficient armament installation, wind tunnel and actual flight tests are conducted to compute or measure the drag forces resulting from the addition of various armament configurations to the basic airplane structure. It is then possible to design a new airplane with the weapon system in mind. Thus the whole airplane is a weapon with all components functioning together as a unit to accomplish one purpose.

Both exterior and terminal ballistic characteristics of pro-

jectiles affect the whole aircraft armament development program and influence the tactics employed in combat. Additional killing power, or terminal ballistic effect, for offense or defense can be provided by adding more guns and turrets. For example, an airplane can be loaded with armament until it can barely fly; but then it cannot get to the target and it becomes useless. At the other extreme, if no armament is provided it can do no damage when it reaches the target. Somewhere between is an optimum arrangement which will yield the maximum of military worth for a given investment of effort and materiel. This is the objective of aeroballistics.

In the study of exterior ballistics—dispatching the bullet to the target—several projectiles of each type are fired on a specially instrumented range on the ground and the time of arrival measured at various points, located at accurately measured distances along the flight path, to determine the muzzle velocity and rate of loss of velocity. Also, the various aerodynamic coefficients of the projectile must be determined. Using these constants and the known theory of exterior ballistics, firing tables are computed for various values of range, airspeed, altitude and direction of fire from the airplane. Sufficient experimental firing must be done to verify the validity of the theory and the accuracy of the computed tables. These tables are computed by the Army Ordnance Corps using high-speed mathematical computing machines. The Air Force in turn utilizes these firing tables in the design and development of fire control computers. These fire control computers are used in aircraft to compute automatically, in the few seconds of combat, the aiming corrections to be applied to the guns to correct for the curvature of the bullet's trajectory and the movement of the target during the bullet's flight to the target.

Rockets

Rockets offer important advantages over guns. The large shock force transmitted to the mount when a gun is fired is not present when a rocket is fired since the propellent gases escape freely into the air. Moreover, a larger weight of warheads can be delivered to the target for a given total weight of armament installation. These advantages allow the use of large diameter rockets which are effective against tougher targets, including armored tanks. Complete loads of rockets can be fired quicker than can the load of ammunition from guns, which allows more favorable tactics to be employed.

But the rocket, because of the more complicated nature

of its motions, presents a more difficult ballistic problem than the gun. A gun fires a bullet with a high muzzle velocity but a rocket is launched with a low velocity relative to the launcher. The rocket is equipped with fins to stabilize it in flight; but since one end of the rocket leaves the launcher first, the rocket tips and tends to wobble. As soon as a finned rocket leaves the launcher it heads into the relative wind. Thus, if the rocket is not mounted parallel to the flight path of the airplane or if the airplane at the instant of launching is skidding or sideslipping, an error is introduced. As soon as the rocket is fired its speed increases until the propellent powder is burned, during which time the rocket may travel several hundred yards. After the propellant has burned, the motion of the rocket resembles that of a finned projectile in free motion gradually losing speed due to air resistance.

A finned rocket continuously oscillates and rotates at a slow rate. A misalignment of the thrust nozzle or a misaligned or bent fin may cause an erratic motion. Also, temperature variations affect the velocity of rockets more than the velocity of projectiles fired from guns.

The motions of the aircraft at the instant of release and the complex motions of the rocket itself tend to produce a dispersion, or scatter, among the paths of a group of rockets, introducing an error in the average point of impact of the rockets. The effect of each contributing factor cannot be separated from the effects of all other factors and measured with high precision. Due to the size of the rocket dispersion, the size of the possible fire control errors and the difficulty of eliminating them, some errors remain in calculating the impact points of rockets even when fire control computers are used. Nevertheless, the rocket remains a potent weapon against difficult targets not vulnerable to standard aircraft gun fire.

Bombs

From the standpoint of exterior ballistics, a bomb may be regarded as a large projectile launched with zero muzzle velocity. The motion of a fin-stabilized bomb may be compared with the motion of a fin-stabilized rocket after the rocket propellant has ceased to burn. In aeroballistics, special importance is attached to the release of bombs. At the high speeds of modern aircraft considerable turbulence of the air exists at the point where the bomb leaves the aircraft. Oscillations imparted when the bomb enters the airstream may cause a large deviation in its path, particularly when the bomb is

dropped from high altitude and descends through a long time of fall. Extensive investigations of the nature of the motions of the various types of bombs dropped from different types of aircraft are necessary to obtain more precise information on the ballistic performance of bombs.

Guided Missiles

Guns are extremely effective at short ranges but, due to lack of guidance as well as the ballistic limitations previously described, their effectiveness diminishes rapidly as range is increased. By combining a guidance system with the desirable characteristics of the rocket—such as a large warhead and high speed maintained throughout a long interval of time—it is possible to construct a weapon which is effective over a long range. In fact, within limits, the weapon may actually become more effective as the range increases, particularly if the errors present at launching can be reduced while the weapon approaches the target.

The guided missile combines the two essential features of any effective weapon system—namely, high hit probability and high destructive capacity at impact. Since in operation a guided missile resembles an airplane, it follows that all of the investigations which are required for subsonic and supersonic aircraft aerodynamics, for stability, control and automatic guidance, are a necessary part of a guided missile design and test program.

Studies of guided missiles not only require new facilities such as high-speed wind tunnels but also the opening up of new areas of research. The high speeds of flight, for example, cause rapid acceleration of the air near the skin of the missile, heating its surface hundreds of degrees and giving rise to a new field of investigation known as "aerothermoballistics." Long-range, specially instrumented test facilities are being constructed by the Air Force for determining the effectiveness of experimental missiles and the design requirements for future missiles as well. Various kinds of guidance systems are conceived and high-speed mathematical computing machines are used to predict the accuracy of the different types of guidance systems. A significant part of the research and development program of the Air Force is directed toward the evolution of guided missiles to supplement present weapons and possibly to replace the present types of weapons as they become obsolete, one after another.

ARMY LANDMARKS

Independence Hall

A century and three-quarters ago this month, delegates from 13 colonies, meeting in Independence Hall in Philadelphia, adopted a Declaration of Independence out of which has grown the powerful United States of America, champion of human liberties and hope of free peoples around the globe.

Designed as the new State House for the colony of Pennsylvania, the building—begun in 1732 and completed in 1759—is part of a group of buildings in Independence Square that includes Congress Hall and Old City Hall.

Independence Hall was the scene of the signing of the Declaration of Independence whose 175th anniversary is observed this month. It served as the meeting place of the Continental Congress; and here the Convention which formulated the Constitution of the United States met in 1787. Congress Hall housed the Congress of the United States from 1790 to 1800 and Old City Hall served as the first seat of the Supreme Court of the United States.

All of the buildings in the group were made a national shrine in 1943 and Independence Square was designated as a national park in 1948. Today it is a mecca, as it always has been, for throngs of visitors who come to view the historic old landmarks and the many mementoes of the early struggle for freedom that are displayed there.

The most famous of these is the Liberty Bell. Originally cast in London to commemorate the 50th anniversary of the founding of the Commonwealth of Pennsylvania, the bell was placed in Independence Hall in 1753. Its name is traditionally associated with ringing out the news of the signing of the Declaration of Independence but it had earlier become known as the Liberty Bell from the Biblical inscription which it bears: "Proclaim Liberty throughout all the land unto all the inhabitants thereof" . . . Leviticus XXV, 10.

(Picture on back cover)

U. S. Army Photograph